The OAIS Reference Model provides a model for managing digital materials in a digital archiving system. It presents a functional model which includes information about the kinds of activities undertaken by each function. The OAIS Reference Model was originally developed for the space data community from the early 1990s. Input was sought from other interested communities to ensure that concepts and terminology in the OAIS Reference Model were commonly understood across different domains. It was widely adopted as a de facto standard, and formally adopted as ISO standard 14721:2003. The OAIS Reference Model is a key standard applicable in most actions in the curation lifecycle.

The OAIS Reference Model defines an Open Archival Information System (OAIS) which performs a long-term information preservation and access function. Its key functions are:

- the *Ingest* function – the process of accepting information provided by Producers. Ingest is ‘responsible for receiving information from producers and preparing it for storage and management within the archive’
- the *Archival* storage function ensures archival context remains secure and is stored appropriately – it ‘handles the storage, maintenance and retrieval of the Archive Information Packages (AIPs) held by the archive’

1 http://public.ccsds.org/publications/archive/650x0b1.pdf
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- the *Data Management* function supports access and updates information – it ‘coordinates the Descriptive Information pertaining to the archive’s AIPs, in addition to system information used in support of the archive’s function’
- the *Administration* function manages day-to-day operations and coordinates other functions
- the *Access* function is the interface with the Designated Community – it ‘helps consumers to identify and obtain descriptions of relevant information in the archive, and delivers information from the archive to consumers’
- the *Preservation Planning* function develops preservation strategies, undertakes technology watch, etc.

![Figure 4: Seven OAIS Functions](Source: Paradigm Project ‘Introduction to OAIS: Functional Model’)

**Actors and objects**

OAIS is based on actors and objects.

**Actors** (who may be human or computer systems) can be:

- *Producers* – individual organisations or systems that transfer digital information to the OAIS for preservation
- *Managers* – who develop policy, define scope, etc
- *Consumers* – individuals, organisations or systems expected to use the information preserved by the OAIS.
The OAIS Designated Community is a category of Consumer. The Designated Community is the primary user group of the OAIS. The OAIS must supply information which is understandable by this group; therefore, the OAIS must have an understanding of the Designated Community's knowledge base.

Objects in OAIS are:

- Submission Information Packages (SIP)
- Archival Information Packages (AIP)
- Dissemination Information Packages (DIP).

OAIS Information packages

OAIS is based on the concept of ‘information package’. This recognises that a digital object consists of much more than just the content that we wish to preserve – it also comprises information that tells us what we need in order to preserve it, information about its attributes, and so on. Curation activities must be as scrupulous about sustainably storing the information about data as it is about storing the data themselves.

An information package consists of three parts:

- The digital object(s) to be preserved
- The metadata required at that point in the system
- Packaging Information.

There are three kinds of information packages:

- Submission Information Package (SIP) – sent to the OAIS
- Archival Information Package (AIP) – what the OAIS produces for archival storage
- Dissemination Information Package (DIP) – what the OAIS delivers when there is a request for access.

Submission Information Package (SIP)

The SIP (Submission Information Package) is what arrives at the repository: the digital object, plus any metadata accompanying the digital object and/or
any other information the content provider considers relevant. SIPs may also be supplied to an OAIS from another digital repository.

Archival Information Package (AIP)

On submission, the SIP is added to if necessary. To the digital materials submitted to the OAIS (known as Content Data Objects) is added Preservation Description Information (PDIs). This is needed to manage the preservation of the Content Data Objects. PDIs have four components:

- Reference Information: a unique and persistent identifier
- Provenance Information: the history of the archived object
- Context Information: relationship to other objects, e.g. the hierarchical structure of a digital archive
- Fixity Information: a demonstration of authenticity, such as a hash value.

In addition, the representation information required to render the object intelligible to its designated community is determined. For example, the information about the hardware and software environment needed to view the content data object.

All this (Content Data Object, PDI, and Representation Information) is encapsulated as an AIP, the basic element of the digital repository.

Dissemination Information Package (DIP)

When a user requests access to an object in the OAIS, a Dissemination Information Package (DIP) is produced. The DIP consists of a copy of the digital object, plus necessary metadata and support systems to retrieve and use the digital object. The accompanying metadata will be a subset of all the metadata relating to that object, such as descriptive rather than technical metadata. The nature of the metadata supplied is determined by the assumed knowledge of the Designated Community.

Representation information

Representation information is an important part of the OAIS information model. Representation Information is the technical metadata that is required to make the bitstream retrievable as a meaningful digital object. For example,
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A web page which includes graphics needs descriptions of the web environment (browser, etc.), the text (ASCII standard), and the image files to make it understandable.

OAIS also lists descriptive metadata – metadata that describes the digital materials – as part of its information model.

OAIS and the curation lifecycle

The curation lifecycle is closely modelled on the OAIS Reference Model. In particular, the sequential actions closely follow what happens in OAIS. The table indicates the correlation (which it should be noted is not exact).

<table>
<thead>
<tr>
<th>OAIS Reference Model</th>
<th>Curation Lifecycle Model</th>
<th>Typical Actions²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission and 'pre-ingest' activities (not part of the OAIS Reference Model)</td>
<td>Conceptualise</td>
<td>• Check any existing deposit schedules to ensure everything expected has been received.</td>
</tr>
<tr>
<td>Create or Receive</td>
<td>Appraise &amp; Select</td>
<td>• Assign the digital object’s unique identifier(s), if not already available, and provide labels for the physical artifact.</td>
</tr>
<tr>
<td>Reappraise</td>
<td>Dispose</td>
<td>• Check for viruses and validate the integrity of the digital object and its physical carrier.</td>
</tr>
<tr>
<td>Dispoese</td>
<td></td>
<td>• Assess in detail the significant properties of the digital object, such as its look and feel, or functionality.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Validate or improve the documentation.</td>
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<tr>
<td></td>
<td></td>
<td>• Where appropriate, reformat the digital object according to repository policies.</td>
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<tr>
<td></td>
<td></td>
<td>• Ensure that all necessary metadata for long-term maintenance and continuing access accompanies the object.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assignment and/or validation of unique identifier.</td>
</tr>
<tr>
<td>Ingest</td>
<td></td>
<td>• Selection and validation of the agreed-on underlying technology or underlying abstract form based on the object’s significant properties.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Transformation of the object as it was submitted, along with its associated metadata, into a bytestream that can be stored on suitable hardware in the repository.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establishment of necessary Representation Information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verification of all PDI.</td>
</tr>
<tr>
<td>Archival Storage</td>
<td>Store</td>
<td>• Moving AIPs from Ingest into permanent</td>
</tr>
</tbody>
</table>

| Migrate | storage.  
• Managing the storage hierarchy.  
• Refreshing the storage media.  
• Providing all necessary information to allow objects to be disseminated from the repository. |
| --- | --- |
| Data Management | Preservation Action | • Pricing information (if applicable) and access controls.  
• Customer profiles.  
• Tracking of user requests.  
• Security information, including any usernames, passwords, digital certificates—anything used to authenticate users of the repository.  
• Statistical information to improve operation. |
| Preservation Planning | Preservation Planning | • Monitoring the designated community.  
• Monitoring technology.  
• Monitoring the significant properties of the repository’s contents.  
• Developing preservation strategies and standards for continuing access.  
• Developing packaging designs and migration or routine transfer plans. |
| Administration | Store | • Negotiating submissions agreements with content producers and providers.  
• Reviewing procedures.  
• Maintaining systems configurations for hardware and software.  
• Developing and maintaining repository policies and standards. |
| Access | Access, Use & Reuse | • Preparation of the DIP  
• Verifying the integrity of the information in the DIP.  
• Ensuring that users have permission for access to the material. |
| Relevant to all OAIS activities | Description & Representation Information | --- |